

REMARKS

Responsive to the non-final office action mailed May 12, 2009, Applicant has studied the Examiner's comments. Claims 1-6 were pending. Claim 1 has been amended. Claims 1-6 remain in the application with only claims 1 and 6 being in independent form. Applicant requests that this Response and Amendment be considered. In view of the following remarks, Applicant respectfully submits that the application is in condition for allowance.

Claim Amendment

The support in the specification for the amendment to claim 1 is as follows:

- *"corresponding to first arrival waves and to waves reflected or converted by the seismic horizons, the seismic data being"* after *"method of processing seismic data"* is supported by paragraphs [0009] and [0010] of US 2007/140056;
- *"by the seismic horizons"* after *"propagation with reflection or with conversion"* is supported by paragraph [0009] of US 2007/140056; and
- *"omnitlr"* after *"acquired by means of a"* is supported by paragraphs [0003] to [0005] of US 2007/140056.

Claim Rejections - 35 U.S.C. 101

The Examiner rejected claims 1-6 under 35 U.S.C. 101 asserting that the claimed invention is directed to non-statutory subject matter. Applicant responds to the rejection as follows, which demonstrates that the claims satisfy 35 U.S.C. 101.

- a) Amended claim 1 explicitly specifies that the seismic data which are processed are data obtained by omnitilt seismic sensor.

Thus, in view of amended claim 1, the data which are processed are always representative of actual physically sensed data and cannot be data that are created mathematically rather than actually measured.

- b) In accordance with the recent decision *In re Bernard L. Bilski*, claims directed to a process that transforms a particular article into a different step or thing, are "*surely patent eligible*" because such claims would not pre-empt all other uses.

It is affirmed by the CAFC in its decision *In re Bernard L. Bilski*, that a controlling factor of the "*machine or transformation*" test concerns the nature of the data that are processed (cf. page 25 § 2 page 26).

In particular, the Court holds that a process is patent eligible if the data represent physical and tangible objects.

- c) Amended claim 1 relates to a method of processing seismic data acquired by omnitilt seismic sensor having at least three geophone components, the method comprising:
- determining estimators which are combinations of these components,
 - isolating various data, through the estimators, depending on whether they correspond to propagation with reflection or with conversion by the seismic horizons,

- determining operators to be applied to the various components of the sensor, the operators being those that minimize a deviation between reference data obtained by applying the estimators to a sensor reconstruction, and
- applying the operators thus determined to the acquired seismic data.

For the determination of patent eligibility of amended claim 1 in light of Bilski, the following elements are relevant and must be given due consideration.

- d) As explicitly mentioned in amended claim 1 the input data which are processed are seismic data obtained from omnitilt seismic sensor.

Seismic data are obtained by propagating seismic waves through the subsurface by means of seismic sources and picking up by means of seismic sensors, signals resulting from reflections of such seismic waves by the subsurface in the area being explored.

Seismic data are produced by physical sensors, and represent physical, tangible objects since they contain information relating to the area of the subsurface through which the seismic waves have propagated. They indisputably meet the condition set out in Bilski and recalled in section "b" above.

Amended claim 1 explicitly specifies:

- the nature of the input data which are processed ("*seismic data*") and
- how said input data are obtained (the seismic data are recorded by omnitilt seismic sensor).

Consequently, the input data which are processed are physical signals representative of physical and tangible objects.

- e) Furthermore the output data of amended claim 1 is the processed seismic data obtained by applying operators determined by minimizing a deviation between reference data obtained by applying estimators to a sensor reconstruction.

Output data derived from physical signals (i.e. seismic data) by applying processing steps retain the "*physical content*" of the signals produced by sensors and their characters are being representative of the same subsurface area i.e. of physical, tangible objects. **Such output data obtained by processing cannot either be equated to abstract, numerical data.**

A method which processes "*physical*" signals representative of physical and tangible objects produces other "*physical*" signals representative of physical and tangible objects.

In the case of amended claim 1, the output data are processed seismic data. Hence the output data of the method defined in amended claim 1 cannot be equated to abstract numerical data.

Consequently, the output data obtained with the method of amended claim 1 are physical signals representative of physical and tangible objects.

- f) A processing method which starts from seismic data in a certain state and produces seismic data in another state is a method which processes "*physical*" signals representative of physical and tangible objects to produce other "*physical*" signals representative of physical and tangible objects. With reference to the rationale set out in *Bilski*, such a method cannot be characterized as pre-empting "*other uses*" for the sequence of processing steps recited in the claim since it does not apply to unspecified data. In contrast, it is defined with reference to seismic data obtained from omnidirectional seismic sensor and has meaning only to the extent it applies to seismic data.
- g) The same remarks apply to claims 2 to 6.

In conclusion, claims 1 to 6 satisfy 35 U.S.C. 101.

Claim Rejections - 35 U.S.C. 102(b)

The Examiner rejected claims 1-4 and 6 under 35 U.S.C. 102(b) as being anticipated by Gaiser (6205403). Applicant responds to the rejection as follows, which demonstrates that the claims are not anticipated by Gaiser, and should be allowable.

- a) Amended claim 1 specifies the nature of the data which are processed.

These seismic data correspond to first arrival waves and to waves reflected or converted by the seismic horizons.

In other words, the present invention provides a method for reconstructing geophones oriented along desired axes using the true data window.

In contrast, Gaiser only uses first arrival waves for determining the orientation of the horizontal components of a geophone (see column 2 lines 54-57 of Gaiser, see also column 3, lines 62-64, column 4 lines 6-9, and column 6 lines 15-16).

It is now indicated in the claims that the invention uses a complete seismic data by explicitly mentioning that the invention uses both the first arrival waves and the waves reflected or converted by the seismic horizons.

Thus amended claim 1 clearly distinguishes from Gaiser which proposes a method using only first arrival waves.

- b) Furthermore, it is now mentioned in amended claim 1 that the data are acquired using an omnitilt sensor having at least three geophone components. The wording "omnitilt" meaning that none of the geophones are to remain in a particular given direction. In particular, the normally vertical geophones are not constrained to remain vertical. In other words, each geophone can be oriented with an angle relatively to the vertical axis.

In contrast, Gaiser proposes a method for determining the orientation of in-line horizontal geophones, vertical sensors of Gaiser being to remain vertical (see column 1 lines 7-9 of Gaiser, see also column 1 lines 48-51 and column 3 lines 13-17).

Thus the language of amended claim 1 clearly mentions that the sensor does not have to remain vertical contrary to the vertical geophones described in Gaiser.

- c) Moreover, Gaiser does not comprise a step of isolating various data, through the estimators, depending on whether they correspond to propagation with reflection or with conversion by the seismic horizons.

On the contrary, in Gaiser, the signals received on the sensor are recorded during a selected time interval so that the processed data window includes only the first arrivals (see Gaiser column 6 lines 15-20).

Thus in Gaiser, the data corresponding to propagation with reflection or with conversion by the seismic horizons cannot be isolated since they are not recorded.

- d) Finally, Gaiser does not describe a method wherein operators to be applied to various components of the sensor are determined by minimizing a deviation between reference data obtained by applying estimators to a sensor reconstruction.

On the contrary, Gaiser proposes determining the operator by minimizing the energy of the firstbreak signal along the line perpendicular to the line from the source to the geophone (see column 5 lines 30-35 and equation 2 of Gaiser).

In conclusion, claims 1-6 are not anticipated by Gaiser.

Claim Rejections - 35 U.S.C. 103

The Examiner rejected claim 5 under 35 U.S.C. 103(a) as being unpatentable over Gaiser as applied to claims 1-4 and 6 and further in view of Baigini (WO151955). Applicant responds to the rejection as follows, which demonstrates that the claims are not made obvious over Gaiser in view of Baigini, and should be allowable.

Techniques for reorienting the data, such as Gaiser, propose using the data which correspond to the first arrival at the sensor for determining a filter intended to be applied to the raw data so as to correct them (see paragraph [0006] of US 2007/140056).

One drawback of techniques such as Gaiser is that they are not optimal since the coupling mechanism which intervenes at the geophone is not the same for the waves which correspond to the first arrival at the sensor and for waves reflected or converted by the seismic horizons (see paragraph [0009] of US 2007/140056).

To overcome this drawback the invention proposes another approach which employs the true data window (i.e. data corresponding to first arrival waves and data corresponding to waves reflected or converted by the seismic horizons) (see paragraph [0010] of US 2007/140056).

This other approach corresponds to the invention as defined in claim 1 and comprises different steps for numerically reconstructing geophones oriented along the desired axes.

Starting from Gaiser, the Man skilled in the art would not be led to the invention as defined in claim 1.

Indeed, Gaiser teaches to the man skilled in the art that only the first arrival waves have to be considered for reconstructing geophones oriented along the desired axes. Thus Gaiser deters the man skilled in the art to use the true data window for reconstructing geophones oriented along the desired axes.

Moreover, nothing in the state of the art suggests to the man skilled in the art to implement the different steps of the invention as defined in claim 1, and in particular:

- isolating various data, through the estimators, depending on whether they correspond to propagation with reflection or with conversion by the seismic horizons, and
- determining the operators to be applied to various components of the sensor by minimizing a deviation between reference data obtained by applying estimators to a sensor reconstruction.

Consequently, claim 5 is not made obvious over Gaiser in view of Baigini, and should be allowable.

CONCLUSION

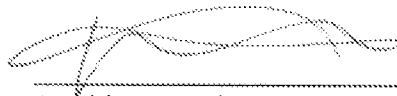
Applicant respectfully submits that all issues have been adequately addressed, that all claims are allowable, and that the case should be advanced to issuance.

If the Examiner has any questions or wishes to discuss the claims, Applicant encourages the Examiner to call the undersigned at the telephone number indicated below.

Respectfully submitted,

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